

Claims

- [c1] A method for forming an electron microscopy calibration standard on a single structure comprising:
- providing a single substrate having at least a first layer and a second layer in lattice alignment;
 - depositing a material of a transformation layer over said second layer;
 - forming a plurality of differing sized bi-layer stacks, each comprising said second layer and said transformation layer;
 - modifying each of said plurality of bi-layer stacks so as to transform said second layer within each of said differing sized bi-layer stacks into a plurality of differing sized island structures with varying lattice parameters comprising said material of said transformation layer, thereby providing a pattern of varying sized features with varying lattice parameters on said single substrate; and
 - fabricating an electron microscopy calibration standard of said pattern of said varying sized features on said single substrate.
- [c2] The method of claim 1 further including separating said

first and second layers with a buried amorphous layer, said buried amorphous layer mechanically decoupling said first layer from said plurality of differing sized island structures.

- [c3] The method of claim 2 wherein said buried amorphous layer comprises a buried oxide layer, and said step of forming said plurality of differing sized bi-layer stacks comprises exposing said buried oxide layer and growing an oxide layer entirely over said bi-layer stacks and portions of said exposed buried oxide layer to form said plurality of differing sized island structures within said grown oxide and said buried oxide layers.
- [c4] The method of claim 3 wherein said first and second layers comprise a first silicon layer and a second silicon layer in lattice alignment.
- [c5] The method of claim 4 wherein said transformation layer comprises SiGe.
- [c6] The method of claim 1 wherein said step of modifying each of each of said plurality of bi-layer stacks occurs at an elevated temperature to enable said transformation of said second layer into said plurality of differing sized island structures with varying lattice parameters while simultaneously consuming said transformation layer, said

plurality of differing sized island structures being entirely covered with a layer.

- [c7] The method of claim 6 wherein said step of modifying each of each of said plurality of bi-layer stacks comprises an oxidation process at said elevated temperature ranging from about 1000°C to about 1320°C.
- [c8] The method of claim 1 wherein each of said plurality of differing sized island structures with varying lattice parameters comprises a single crystal feature.
- [c9] The method of claim 1 wherein said pattern of varying sized features with varying lattice parameters on said single substrate is determined using a Moire fringe spacing that covers each of a magnification setting across a range of magnification settings for said electron microscopy calibration standard to be fabricated from said single substrate.
- [c10] The method of claim 9 wherein said range of magnification settings ranges from 5000X to 200,000X.
- [c11] The method of claim 1 wherein said electron microscopy calibration standard comprises a scanning transmission electron microscope calibration standard or a transmission electron microscope calibration standard.

[c12] A method for calibrating an electron microscope comprising:

- providing an electron microscope having a range of magnification settings;
- providing a single substrate having at least a first layer and a second layer in lattice alignment;
- depositing a material of a transformation layer over said second layer;
- determining a plurality of Moire fringe spacings that cover each magnification setting across said range of magnification settings for said electron microscope;
- forming a plurality of differing sized bi-layer stacks of said second and transformation layers across said single substrate based on said plurality of Moire fringe spacings;
- modifying each of said plurality of bi-layer stacks so as to transform said second layer within each of said differing sized bi-layer stacks into a plurality of differing sized island structures with varying lattice parameters comprising said material of said transformation layer, therein providing a pattern of varying sized features with varying lattice parameters on said single substrate;
- fabricating a single electron microscopy calibration standard of said pattern on said single substrate, thereby said single electron microscopy calibration standard being calibrated for each of said range of magnification

settings; and

calibrating said electron microscope using said single electron microscopy calibration standard.

[c13] The method of claim 12 wherein said range of magnification settings ranges from 5000X to 200,000X.

[c14] The method of claim 12 further including separating said first and second layers with a buried amorphous layer, said buried amorphous layer mechanically decoupling said first layer from said plurality of differing sized island structures.

[c15] The method of claim 14 wherein said buried amorphous layer comprises a buried oxide layer, and said step of forming said plurality of differing sized bi-layer stacks comprises exposing said buried oxide layer and growing an oxide layer entirely over said bi-layer stacks and at least portion of said exposed buried oxide layer to form said plurality of differing sized island structures within said grown oxide and said buried oxide layer.

[c16] The method of claim 12 wherein said step of modifying each of each of said plurality of bi-layer stacks occurs at an elevated temperature ranging from about 1000°C to about 1320°C to enable said transformation of said second layer into said plurality of differing sized island

structures with varying lattice parameters.

[c17] The method of claim 12 wherein said electron microscopy calibration standard comprises a scanning transmission electron microscope calibration standard or a transmission electron microscope calibration standard.

[c18] A structure for fabricating an electron microscopy calibration standard comprising:
a single substrate having a first layer and a second layer;
a plurality of differing sized island structures with varying lattice parameters comprising a material of a transformation layer over said second layer, said plurality of differing sized island structures providing a pattern of varying sized features with varying lattice parameters on said single substrate and
a third layer over portions of said second layer and entirely covering each of said plurality of differing sized island structures with varying lattice parameters,
wherein said first layer and each of said plurality of differing sized island structures have varying fringe spacings across said single substrate corresponding to a range of magnification settings for said electron microscopy calibration standard.

[c19] The structure of claim 18 wherein said material of said plurality of differing sized island structures with varying

lattice parameters comprises SiGe.

[c20] The structure of claim 19 wherein said first layer comprises silicon, said second silicon layer comprises oxide and said third layer comprises grown oxide .